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Optimal Capital Structure and Share Repurchases: A Case Study of Anglo American plc

Submitted as part completion of MCom with specialisation in Financial and Risk Management

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Abstract

During 2006, AAL adopted and implemented its first share repurchase program, which continued up until its suspension in 2008. While management stated that share repurchases would only be done in the interest of shareholders, the repurchase program was disastrous for shareholder value. Management also stated that share repurchases provide the firm with flexibility regarding its capital structure.

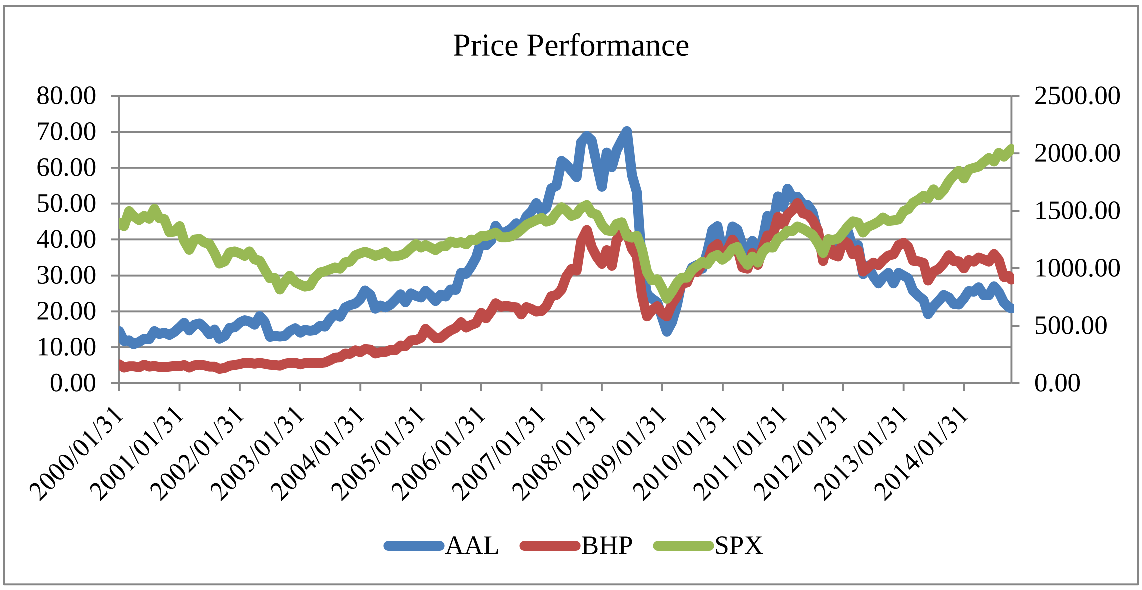
We investigated the capital structure of AAL for the years 2004 to 2012 from an optimal capital structure perspective. Using a CAPM approach, we find no evidence that AAL targeted or implemented a capital structure, which could be considered optimal.

Due to the onset of the financial crisis in 2008, it is of interest to determine whether the fall in share price recorded by Anglo American plc ("AAL") is due to the general decline of the market, or due to some other reason specific to AAL. While there can be no doubt that the financial crisis and the resultant market deterioration had a detrimental effect on all stocks, including AAL, the question is whether AAL was less or more affected than average (i.e. than the market decline)? Did investors, in the face of the financial crisis, view AAL more or less favourably to other stocks? In an attempt to answer this question, we compare the stock price performance of AAL to that of BHP Billiton Ltd ("BHP") and the S&P 500 index ("SPX").

From the period January 2001 to December 2007, AAL recorded share price growth of 330.35% in USD terms. This is compared to BHP and SPX which recorded growth of 636.30% and 11.22% respectively. Between 2007 and 2010, AAL reached a price high of USD70.20 in June 2008, before losing 79.54% in value to record a lowest price of USD14.36 eight months later. Before falling 51.46% to reaching a low of USD18.59 in February 2009, BHP reached a high of USD42.70 in October 2007. The SPX recorded a high of 1549.36 in October 2007 before dropping to a low of 735.09 in February 2009, a loss in value of 52.56%.

AAL therefore experienced a loss in share price value fifty percent greater than the market (SPX) while BHP lost only seven percent more than the market in value. Furthermore, both BHP and SPX subsequently returned to their recorded highs whereas AAL never has.

Figure 1: Price performance



This inferior performance of AAL against both the market and another diversified mines raises the question as to why it developed so poorly. While there may be any number of reasons, this study investigates the capital structure leading up to AAL's marked share price's decline and the period following it. While we do not argue that the management of AAL should have foreseen the debt crisis of 2008, it is reasonable to expect management to follow a robust capital structure. Of particular interest is the share repurchase program first adopted by AAL in 2006 which continued until 2008, the period immediately preceding the debt crisis.

In this study, we analyse the actual capital structure followed by AAL during the period 2004 to 2012 and compare this to an estimated optimal structure for the same period.

The rest of the paper proceeds as follows. Section 1 provides a review of existing literature. Section 2 details the share repurchase program adopted and implemented by AAL. Section 3 lays out the methodology used to determine the historic capital structure of AAL and optimal capital structure estimate. Section 4 provides the result of the analysis. Section 5 considers other theoretical arguments for share repurchase decisions and investigate the relevance of these to AAL. The paper concludes in Section 6. Full working of the model used are shown in appendices.

1. Review of literature

Share repurchases

Since the legalization of share repurchases, share repurchase programs have gained increased popularity. Internationally, particularly in the USA, the impact of share repurchases has been widely researched. The majority of this research has focused on the effect of share repurchases on returns. In South Africa, the research on share repurchases is extremely limited.

Firms can return cash funds to shareholders in one of two ways: declaring a dividend or repurchasing stock. Historically, dividends have been the preferred method for managers to return cash to shareholders. However, since the introduction of share repurchases, the instances of repurchases have increased, to the detriment of dividend declarations.

Share repurchases rose in popularity in the USA from 1982 after the adoption by the SEC of a safe harbour rule that protected companies from being sued for price manipulation (Brockman, Khurana & Martin, 2008). Until then, companies had been reluctant to repurchase shares due to the perception of market manipulation that they carried. Since then, the number of shares repurchased has increased dramatically. By the late 1990s, the value of repurchased shares exceeded that of dividends paid to shareholders of AMEX, NASDAQ and NYSE listed companies for the first time (Hencock & White, 2007). In Europe, it was only in the late 1990s that share repurchases gained increasing attention, mainly because repurchases were widely illegal before then (Andriosopoulos & Hoque, 2013). In some countries, the slow adoption of share repurchases was due to the fact that open-market repurchases were considered to be price manipulation (Grullon & Michaely, 2002). Today, open-market share repurchases are the most popular relative to Dutch auctions or tender offers (Stephens & Weisbach, 1998). In South Africa, share repurchases have been legal since 1999.

Generally, share repurchases have been found to precede positive abnormal share price returns. Ikenberry et al (1995) find a long-run abnormal return for value stocks for a period of four years following a repurchase announcement. They study the abnormal returns following open-market repurchases by ASE, NASDAQ and NYSE listed companies from 1980 to 1990 and find a 3.5% response to the initial announcement and 12.1% return (above initial announcement reaction) to a four-year buy-and-hold strategy following a repurchase announcement. Furthermore, the return is greater for companies with high book-to-market ratios or out-of-favour companies. They report a 45.3% above average return for such companies (Ikenberry, Lakonishok & Vermaelen, 1995). Open-market stock repurchase announcements have empirically been found to result in share price increases, regardless of whether shares were actually repurchased (Oded, 2005).

A number of ideas have been hypothesized as to why share repurchases may be preferred over dividends. Relative to dividends, share repurchases preserve a company's financial flexibility as they do not commit a company to additional future payouts in the same way that dividends do (Jagannathan, Stephens & Weisbach, 2000). In addition, companies announcing open-market share repurchase programs are not obligated to repurchase the specific number of shares. Although companies are not bound to their dividend payout policies, in practice companies do risk a decrease in share price as a result of a dividend cut. In this way, repurchases provide greater flexibility with none of the risks (to share price) of dividends. Repurchases are therefore a good way to make cash repayments to shareholders that may not be sustainable, without risk to the share price in the future (Jagannathan, Stephens & Weisbach, 2000). In support of this notion, their study suggests that companies with more volatile cash flows are more likely to use share repurchases that dividends (Jagannathan, Stephens & Weisbach, 2000). Skinner (2008) finds that, for both firms that have always paid dividends and for firms that only make repurchases,

repurchases increasingly substitute for dividends (Skinner, 2008). Others report that repurchases are positively related to both expected and unexpected cash flow (Stephens & Weisbach, 1998).

Fama & French (2001) find that in the USA, large companies and more profitable firms are more likely to pay dividends, while companies with more investment opportunities are less likely to pay dividends.

Part of the reason for the reported decline of dividends paid by listed companies in the USA over the past few decades is the change in the characteristics of new firms listing. As discussed by Fama & French (2001), for the period before 1999, the new firms that listed before 1978 were more profitable that those that listed after 1978. This decline in profitability of newly listed companies after 1978 is accompanied by a decline in dividends paid. Where one third of newly listed firms paid a dividend before 1978, only 3.7% of newly listed firms paid a dividend between 1978 and 1999 (Fama & French, 2001). However, this does not fully explain the decrease in dividends paid. That same study finds that, not only are newly listed firms moving away from dividend payments, but all firms are, regardless of their characteristics (Fama & French, 2001). This move away from dividends was accompanied by a move to greater share repurchases. From the time that repurchases were made legal, USA companies have been substituting repurchases for dividends (Grullon & Michaely, 2002).

Interestingly, Grullon & Michaely (2002) find no statistically significant negative market reactions to dividend decreases for companies that repurchase shares. This is in contrast to their findings for companies that do not repurchase their shares.

Motives for share repurchases

Many theories exist as to what would motivate companies to repurchase their shares. The most prominent of these is the signaling hypothesis. Share repurchase programs may convey two different signals to the market. The first is that no new suitable investment opportunities exist which could earn shareholders their required return. It is therefore better to return free cash to shareholders in the form of repurchases in order for shareholders to invest it themselves. The second, and more importantly, is that managers believe the company is undervalued. Under the latter scenario, it is believed that mangers have better knowledge of the company, its future prospects and therefore its value, than the market does. An announcement of a share repurchase program would therefore be a positive signal to the market. Vermaelen (1981) finds that the signaling hypothesis explains a large extent, larger than the other hypothesis, of the abnormal returns recorded after a tender offer. Stephens & Weisbach (1998) find that “repurchases are negatively related to prior stock price performance, suggesting that firms increase their purchasing depending on its degree of perceived undervaluation”.

Opponents of share repurchases feared the possibility of insider trading as a result of market signals which could be manipulated by managers (Vermaelen, 1981). They feared that because open-market share repurchase announcements do not commit managers to those repurchases, managers may use repurchase announcements as a way of misleading the market in the hope that this will increase the company’s share price. As discussed above, Stephen & Weisbach (1998) argue that open-market share repurchases are increasingly popular due to the financial flexibility which they provide to managers and not as a result of managers trying to manipulate their firm’s share price.

Alternative motivations for repurchasing shares include capital structure adjustments, take-over defenses, personal tax considerations and wealth expropriation from bondholders. In this study the focus lies on the motive relating to capital structure adjustments.

Capital structure

The theory of capital structure has been the subject of much research and debate ever since the seminal paper by Modigliani and Miller (Modigliani & Miller, 1958). However, even with all this attention, these still is no consensus as to what constitutes an optimal capital structure. Modigliani and Miller first purported that the make-up of a firm’s capital structure is irrelevant.

Graham et al (2014) find that the aggregate debt-to-capital ratio of unregulated firms ranged from 10% to 15% from 1920 to 1945. From 1945 to 1970, this leverage tripled to 35%, above which it remained post 1970 to 1990. If non-debt liabilities were to be included in the leverage calculation, leverage increased to 60% by 1990. This increase in leverage resulted not only from an increase in liabilities of firms, but also from a lesser utilization of current assets, especially cash. Where cash and current assets made up 25% of assets in 1945, this percentage fell to only 6% in 1970 and 10% in 2010. The leverage of nonfinancial regulated firm, on the other hand, remained stable over the same period. Furthermore, Graham et al (2014) find little contribution of firm characteristics to their findings. Most especially, they find traditional empirical models based on firm characteristics are unable of explaining the capital structure trends recorded over the past century (1920 to 2010). They therefore hypothesis that, with firm characteristics unable to explain the change in leverage, such change must have been due to macroeconomic influences. The factors that they consider are taxes, economic uncertainty financial sector development, managerial incentives and government borrowing.

Of these, the factor found to have the largest effect on leverage was government leverage (i.e. Federal debt to GDP). The relationship between government debt and corporate debt was found to be negative with a one standard deviation increase in government leverage associated with a quarter standard deviation decrease in the leverage of unregulated firms. This effect was significantly larger than for any other macroeconomic factor.

Other than a positive relationship found between leverage and the output of the financial sector, Graham et al (2014) find no other macroeconomic factors to have a statistically significant impacts on corporate leverage.

Studies on corporate capital have focused of four main themes to explain the determinants of capital structure. These four main themes are agency costs, signaling or asymmetric information, products and market interactions and corporate control.

The main concern of these theories is the benefit of debt versus equity, and the effects debt can have versus equity on the relevant topic of study. These theories are discussed on more detail below.

Agency costs

Agency costs refers to the conflict of interests between stakeholders. This conflict arises where one stakeholder's interests in maximizing its own benefit is to the detriment, or at least not to the benefit, of another. Jensen & Meckling (1976) identify conflicts between "managers and shareholders and between shareholders and debt holders". Conflicts between managers and shareholders arise, as mangers do not achieve total gain from their profit maximizing efforts as they are entitled to less than 100% of any resultant profits. Instead, this entitlement held by shareholders. Managers, however, bear the total cost of their efforts. As a result, managers my reduce their profit maximizing efforts, while at the same time consuming more company resources. The authors term these resources consumed by managers for personal gain, "perquisites". The consequence of this conflict between managers and shareholders is that managers reduce their profit maximizing efforts in exchange for consuming these perquisites. Furthermore, the extent of this conflict is greater in the case where managers hold less equity.

The agency cost theory of capital structure therefore suggests that debt can reduce the conflict between managers and shareholders by increasing the equity claim of managers. In addition, debt reduces the perquisites available to managers as cash resources previously available (in the absence of debt) now become tied to servicing the debt. This reduction in conflict between managers and shareholders, though the adoption of debt, therefore supports *ceteris paribus* the increase in debt in corporate financing.

The conflict between shareholders and debt holders results where shareholders are incentivised to invest sub-optimally. Where an investment is successful, shareholders enjoy the majority of the gain, while debt holders capture only the value of the debt. However, where an investment is unsuccessful, debt holders bear the loss. In this way, shareholders are incentivised to adopt risky investments in the interest of high returns, while at the same time bearing the same risk, i.e. at most, the face value of the debt. However, the cost borne by debt holders can be transferred to shareholders where debt holders can foresee the future risky investing behavior of shareholders and consequently increase the cost of debt originated. Shareholders will then receive a lower price for their debt and be less incentivized to undertake risky investments. This is referred to as the "asset substitution effect".

Considering these conflicts, an optimal capital structure would be found where these agency costs are mitigated by the adoption of debt.

Signaling or asymmetric information

Under the theories of asymmetric information, managers are considered to hold inside or private information regarding the company. A number of theories therefore seek to explain how debt can covey this inside information of managers, to outsiders. As first suggested by Ross (1977) and Leyland & Pyle (1977) the capital structure of a company can convey this inside information to outsiders. Alternatively, as first suggested by Myers & Majluf (1984) and Myers (1984), capital structure "is designed to mitigate the inefficiencies in the firm's investment decisions that are caused by the information asymmetry" (Harris & Raviv, 1991).

In the model developed by Ross (1977), managers know the distribution of company returns, while shareholders do not. Where managers benefit from the company's securities being highly valued but stand to lose in the case of bankrupt, larger debt levels are a signal to investors of a higher quality company. Managers of low quality firms are dissuaded from imitating higher quality through debt by the higher cost of bankruptcy of lower quality firms.

Trade-off theory

Companies trade-off the benefits derived from debt financing with the costs arising from adopting increasing levels of leverage such as higher interest rates and the risk of potential bankruptcy costs.

Bankruptcy costs may include: loss of customers and key employees, higher interest rates, inability to undertake value-adding projects, distraction of management away from core functions, reductions in research and development and competitors are provided with an advantage (Correia, et al., 2011).

Pecking order theory

The Pecking order theory assumes that there is not target capital structure. Instead, this theory suggests that finance is raised in accordance with a preferred hierarchy. First, it is preferred that projects be financed from retained earnings. Once retained earnings are exhausted, additional funding will be provided by way of debt. Lastly, the issuing of equity is the least preferred method of finance. By following this approach, companies always use the cheaper means of finance before moving to a more expensive alternative.

Review of other empirical studies of capital structure

Morellec (2001) investigate the relationship between corporate debt liquidity and capital structure and finds liquidity increased leverage only when bond covenants restrict the sale of assets. However, in the case of unsecured debt, he finds that “greater liquidity increased credit spreads on corporate debt and reduces optimal leverage” (Batten & Hogan, 2002).

Korajczyk & Levy (2003) model the target capital structures of firms as a function of macroeconomic conditions and firm-specific variables. They base their analysis on financially “constrained” and “unconstrained” firms. They use the following criteria in classifying a firm as being financially constrained: “1) the firm does not have a net repurchase of debt or equity and does not pay dividends within the event window, and 2) the firm’s Tobin’s Q, defined as the sum of the market value of equity and the book value of debt, divided by the book value of assets, at the end of the event quarter should be greater than one. A firm-event window is labeled as financially unconstrained if it does not meet these two criteria”. Based on these criteria, Korajczyk & Levy (2003) find 565 firm-event windows as financially constrained and 5095 as unconstrained. They conclude that “target leverage is counter-cyclical for the unconstrained sample, but pro-cyclical for the constrained sample". In other words, "macroeconomic conditions are significant for the issue choice for unconstrained firms but less so for constrained firms" (Korajczyk & Levy, 2003).

Kayhan & Titman (2007) investigate the effect of cash flows, capital expenditure and stock price histories on debt ratios. They find that stock price changes and external capital have strong influences on capital structure changes. However, they find that over the long-term, firms tend to move towards a target capital structure (Kayhan & Titman, 2007).

In analysing the effects of industry deregulation on capital structure, Ovtchinnikov (2010) finds that, following deregulation, firms experience a decline in leverage in response to the significant decline in profitability and increased growth opportunities. Following deregulation, leverage is found to be more positively correlated to firm size and negatively correlated to earnings volatility. Furthermore, consistent with trade-off theory, following deregulation, firms that are "above their target capital structure issue significantly more equity in the first few years following deregulation" (Ovtchinnikov, 2010).

Many firms set target capital structures, although it may take a significant amount of time to achieve this target. Other firms which meet their target capital structure may deviate from it. Uysal (2011) finds that firms planning acquisitions take these deviations from their targeted capital structures into account. Over-leveraged firms, relative to their target, are less likely to make acquisitions and are less likely to make offers of cash. Such firms also acquire smaller targets and pay lower premiums (Uysal, 2011).

Consistent with the dynamic trade-off theory, Danis et al (2014) find that when firms are close to or at their optimal leverage, "the cross-sectional correlation between profitability and leverage is positive" while otherwise the correlation is found to be negative (Danis, Rettl & Whited, 2014).

Hovakimian et al (2004) investigate whether firm operating performance affects corporate financing behaviour. Considering firms which issue both new equity and debt, Hovakimian et al (2004) suggest that firms with high market-to-book values have low target debt ratios. Furthermore, high stock returns increase the probability of equity issuance, with no effect on target leverage (Hovakimian, Hovakimian, & Tehranian, 2004).

2. AAL's share repurchase program

The share repurchase program implemented by AAL in 2006 marked the first time that the company had undertaken such a program. Share repurchases were first mentioned by AAL in its 2005 Annual Report with the following statement:

> *"Our strong financial position affords us the opportunity to return USD1.5 billion of capital in 2006 in the form of a USD1 billion buyback as well as a USD0.5 billion special dividend. The capital structure will be reviewed regularly in light of market conditions, operating cash flows and progress on strategic delivery and capital projects."*

AAL's share repurchase program commenced in March 2006. The first repurchase program adopted by AAL, it was originally intended to return USD9 billion to shareholders (USD6 billion announced in 2006 and USD3 billion announced in 2007) via three tranches of repurchases. During 2006, the company repurchased USD3.9 billion worth of stock.[1] The addition USD3 billion repurchase program announced in February 2007 was completed by August of that year. It was followed by an announcement of an addition USD4 billion repurchase program, USD1.3 billion of which had been completed by February 2008. In total, USD1.7 billion of the intended USD4 billion of the third repurchase program was completed before its suspension in October 2008. The share repurchase program was suspended as a result of the onset on the global liquidity crises at that time in 2008. However, the repurchase program was never resumed.

In addition, there is no information or guidance provided as to what the target capital structure of AAL is. However, in the Director's Report in the 2004 Annual Report of AAL, it is stated that during the Annual General Meeting to take place in April 2005, renewal would be sought for the following existing authority of directors to:

> *"make market purchases of up to a maximum of 149 million ordinary shares of $0.50 each of the Company, being up to 10% of the ordinary issued share capital at 22 February 2005, at a price not less than $0.50 and not exceeding 105% of the average middle market closing price of such shares on the London Stock Exchange on the five dealing days prior to the date of repurchase."*

[1] Page 35 of AAL's 2006 Annual Report.

Of relevance is a comment contained in the same statement regarding earnings per share and capital structure:

> *"The directors have no present intention of exercising this authority and would only do so if they considered it was in the best interests of shareholders generally and if the purchase could be expected to result in an increase in earnings per share… Treating the bought-back shares as treasury shares gives the Company the ability to sell or transfer them quickly and cost-effectively and provides the Company with additional flexibility in the management of its capital base"*

This statement points to the desire of AAL's directors to use repurchased shares (held as treasury shares) as a means of actively and managing the company's capital structure.

Commenting on the specific share repurchase program adopted by AAL, the following statement was in the Director's Report contained in AAL's 2006 Annual Report:

> *"The strong cash generation from our operations, as well as proceeds from non-core disposals, resulted in 2006 in the announcement of a $7.5 billion return of capital in the form of share buybacks and special dividends – one of the highest levels of capital return in the industry – in addition to $1.4 billion in ordinary dividends paid in 2006 and a further $1.1 billion final dividend recommended in 2007.*
>
> *The Group produced record underlying earnings of $5.5 billion, 46% higher than 2005, with record production levels at many of its mining operations. With strong cash flow, the Group announced during 2006 and early 2007 the return of $10.5 billion to shareholders through share buybacks and special dividends."*

3. Methodology

Historical capital structure reported by AAL

The approached followed in this study is to determine what may be considered to be an optimal capital structure for AAL. This is done by determining optimal levels of debt and equity without making any assumptions regarding changes to AAL's operations. Operating profit is therefore kept constant at the values actually reported by AAL in the years under review. To do so, an optimal weighted average cost of capital ("WACC") is determined for AAL for each of the years 2004 to 2012. This nine-year period was chosen on the basis that it includes the years prior, during and after the share repurchase program was implemented by AAL. Data constraints limited an analysis of years earlier than 2004.

The analysis prepared in this study relies on the principles of the Capital Asset Pricing Model ("CAPM") in order to determine the cost of equity ("COE") of AAL. Criticism of the CAPM is widely documented, and while beyond the scope of this paper, these criticisms have been briefly discussed below. However, for the reasons discussed in support of the CAPM, the CAPM methodology was considered suitable and has been used for the purposes of this study.

All analyses are performed in USD, the functional currency of AAL.

In order to evaluate the actual cost of capital achieved by AAL over the period under review, as found below, we follow a methodology put forward by Damodaran (2004) which considers an optimal capital structure. An optimal capital structure for AAL is proposed using a cost of capital method. The process involves determining an optimal capital structure by selecting the debt-to-capital ratio that results in the lowest WACC. The COE, cost of debt ("COD") and resultant WACC are calculated for each year 2004 to 2012 and for every decile of the debt-to-capital ratio. These analyses of COE, COD and WACC are discussed below.

Given that the cost of capital is comprised of COE and COD, changing the respective weights of these two variables may alter the cost of capital. Under this approach, we calculate the COE and the COD at different levels of debt and equity. The WACC is then calculated from these two components for the each of the different debt levels. At the lowest cost of capital in each respective year it can be said that the optimal capital structure is found and that the firm's value is maximised.

The WACC is defined as the weighted average of the different types of financing used by the firm, namely equity and debt:

$WACC = W_e \times K_e + W_d \times K_d,$

where W_e *equals the weighting of equity as a percentage of capital,* $E/(D+E)$*;* K_e *equals the cost of equity;* W_d *equals the weighting of debt as a percentage of capital,* $D/(D+E)$*; and* K_d *equals the cost of debt.*

The components of the WACC for AAL and how they were determined are discussed below.

Cost of Equity and the CAPM

As stated above, the approach used in this paper to investigate the capital structure of AAL makes use of the CAPM to determine the COE component of the WACC.

Much of the criticism leveled against the CAPM is due to the CAPM's reliance on historical data for the prediction of future outcomes. It is fair to say that the CAPM is largely used in valuation exercises, which require an analysis and consideration of future expectations. In this scenario, the use of historical data can only be accurate if future expectations do no differ from historical results. This constraint is obviously problematic. However, this study relies on the CAPM not for valuation purposes, but for calculating the actual historic WACC position of AAL for the period 2004 to 2010. As no assumptions of future expectations are required, the use of historical data relating to these years was appropriate and not subject to the historical data problem of the CAPM.

Further criticism is leveled against the CAPM as many consider it to lack empirical support. Despite this criticism leveled against the CAPM based on a lack of empirical evidence in its favour, it continues to be widely used by managers and financial analysts. In its survey of Australian financial analysts and corporate financiers, KPMG reported that the CAPM is the most common method used to derive cost of equity, with 82% of respondents reporting that they always use the CAPM (KPMG, 2013). Zero respondents reported using the Arbitrage Pricing Theory. PWC found a comparable preference for the CAPM in South Africa. In its 2009/2010 survey, PWC reported that the CAPM was "the primary methodology used to estimate the cost of equity, with all respondents stating that they either always or frequently use it" (PWC, 2010). This is further corroborated by JP Morgan which states that "most practitioners use CAPM as their method of choice to estimate the cost of capital" (Zenner, et al., 2008).

Therefore, despite criticism against the CAPM, is continues to be the most commonly used method for determining cost of equity. It therefore does not seem unreasonable to assume that capital structure designs and decisions are made, in practice, based to a large degree, on the CAPM. It is therefore not unlikely that AAL's management may also have relied on the CAPM when making decisions regarding capital structure.

It is for this reason that the CAPM is considered an appropriate methodology for use in this paper to analyse the historical capital structure of AAL.

$K_e = RFR + \beta \text{ x } ERP$

where K_e equals the costs of equity, RFR is the risk-free rate, β represents the regression beta of AAL and ERP is set as the equity risk premium.

Risk-free rate

The USA 10-year Treasury bond rate was chosen as the representative risk-free rate used in this analysis. There are a few reasons for this choice of rate. Firstly, Treasury bonds are dollar denominated and therefore match the currency of our analysis (the functional currency of AAL). Furthermore, the USA market is one of the most diverse and liquid and is considered to be largely default free. Furthermore, using a long-term bond rate, instead of a short-term bill, better matches the term of project undertaken by AAL, as well as the period of our analysis.

The annual arithmetic mean values of daily data were used in the analysis.

Table 1: Risk-free rate

10-Year Treasury (%)									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Rate on 10-Year Treasury Bonds	4.27	4.29	4.80	4.63	3.66	3.26	3.22	2.78	1.80

Beta

Beta, another component of the CAPM, represents the sensitivity of an individual stock to changes in the market, which has a beta coefficient of one. It represents the systematic risk of a stock, that risk which cannot be eliminated through diversification.

Beta values were determined for AAL for each of the years 2004 to 2012. The betas calculated were not forward-looking, but actual betas calculated from historical data. Betas were calculated by regressing the returns of AAL against the returns of the SPX.

A beta period of five-year monthly returns was used. In choosing the period over which to estimate the regression betas, care must be taken to choose a period which is long enough to contain sufficient information, but which is also not so long that is no longer reflects the true nature of the business. Two points are relevant here. First, as AAL is predominantly involved in mining operations, five years does not represent a long time period when considering the long lead times of mining projects, nor has its business operations changed significantly over time. Secondly, again, the beta estimates are not required for forecasting purposes. Rather, the beta regressions performed estimate the betas based on historical data and actual business operations, as intended.

Table 2: Regression betas

Regression Betas									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Regression Beta	0.82	0.90	0.83	1.53	1.69	1.87	1.88	1.74	1.72
R^2	0.20	0.23	0.20	0.31	0.46	0.55	0.57	0.59	0.56

Equity risk premium

The equity risk premium ("ERP") is perhaps the most contentious component of the CAPM. While the CAPM speaks of a market portfolio comprising all securities, no such measurable portfolio exists in reality.

In choosing a specific index as a representation of the market, according to the CAPM, the choice of index should not be based on the specific industry or location in which the tested party operates. Instead, the choice of index should be that which best reflects the market portfolio, as required by the CAPM. Therefore, while AAL has its primary listing on the FTSE, the SPX was chosen as it is considered to best represent the market portfolio, due to the fact that is contains a large number of liquid stocks and is well diversified and therefore better meets the criteria of a market portfolio.

However, even after a determination of the market portfolio is made, a number of challenges remain in determining a suitable ERP. How can the market premium then be measured over the risk-free rate? A common method is to measure the return of equities over the risk free rate. Again, the issue arises as to what period and measure of return should be used.

The ERP is typically calculated using historical data as the average realised return of an equity index over the average realized return of USA Treasury Bonds. However, the choice of time period, as well as the choice of arithmetic or geometric average can significantly affect the result. Such a method also does not account for changes in the ERP as a result of changing market conditions, for example. The following table presents various measures of the ERP prepared by JP Morgan (Zenner, et al., 2008).

Table 3: Equity risk premiums

Large company stocks – Intermediate Treasury Bonds		
Period	Arithmetic mean	Geometric mean
1926 – 2007	6.9%	5.1%
1946 – 2007	6.8%	5.7%
1978 – 2007	5.7%	4.9%

Source: Table taken from Zenner, et al. (2008)

An alternative method for determining the ERP is to use a dividend discount model. However, this method requires predicting a number of variables of the model, namely expected dividends, earnings and perpetual growth rates. This reliance on forecasted variables therefore poses a weakness of the model. Furthermore, if expected dividends are not frequently updated, then dividend discount model also suffers from the problem of not being able to account for changes in market conditions.

The Sharpe Method is yet another approach which can be used to estimate the ERP. JP Morgan calculates, using a Sharpe ratio of 0.3 for the SPX (as a proxy for the market), that the ERP ranged from 8.2% in 1998 to 7.2% in 2008. The rates for each of the ten years in shown in the table below (Zenner, et al., 2008).

Table 4: Market risk premiums

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Average MRP	8.2%	7.8%	7.4%	7.9%	8.0%	6.6%	4.6%	3.9%	3.7%	5.2%	7.2%

Given the range of methods that can be used to calculate ERP, the question arises which method to use. It is difficult to prescribe one method as being better than another. We have therefore presented a number of different methods and some corresponding result in order to give an indication of the expected ERP. For the purpose of this analysis, the arithmetic average return of the SPX over Treasury bonds over the period 1928 to 2010 is used. This ERP rate is obtained from research by Damodaran (2006), which is consistent with the above research.

Cost of debt

The determination of the COD in our analysis relies on two components; the risk-free rate and the default spread relevant to AAL over the risk-free rate. Being a large listed entity and an important company in the global mining industry, AAL was rated by all three of the major credit rating agencies (Standard & Poor’s, Moody’s and Fitch) over the period of review. Default spreads were referenced from the Moody’s MIR database.

Moody’s credit ratings where used for the purpose of our analysis in order to be consistent with Moody’s data used for determining credit default spreads.

The COD was calculated as the sum of the relevant risk-free rate and default spread.

Risk-free rate

As discussed above, the risk-free rate used in the calculation of the cost of debt is the USA 10-year Treasury bond rate.

Default spread

To determine the appropriate default spread, AAL's credit ratings for the years 2004 to 2012 were used. These ratings were obtained from the Bloomberg database.

The Moody's ratings for AAL were then used to determine the default spread. The reason for this is that the Moody's data of spreads per rating, based on date and maturity, were used to determine the appropriate default spreads. Default spread data were obtained from the Moody's MIR database. The Moody's ratings were therefore used to match this data. Default spreads per rating were calculated per year as the arithmetic mean of daily default spread rates over USA Treasury bonds and maturity was set at ten-years.

Moody's credit ratings of AAL were taken as applicable at the end of the respective financial years.

Table 5: AAL ratings and corresponding Moody's default spreads

Moody's compiled default spreads									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
S&P rating	BBB	BBB	A-	A	A	A-	A-	A-	A-
Moody's rating	Baa1	Baa1	A3	A2	A2	A3	A3	A3	A3
Default spread (b.p.)	237	235	499	180	90	101	51	76	163

Taxation

The tax rate used is the marginal UK corporate income tax rate. AAL is incorporated and tax resident in the UK. It is for this reason that the UK rate is used. AAL does quote its effective tax rate in its financial statements, however, this is nevertheless not considered appropriate as the effective tax rate may be affected by items not related to the interest bearing debt of AAL.

Table 6: Taxation rates

Taxation rate (%)									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
UK marginal tax rates*	30	30	30	30	30	28	28	26	24
AAL effective tax rates**	30	26.5	32.7	31.8	33.4	33.1	31.9	28.3	29.0

*Source: * HMRC, **AAL*

Market value of equity

For the same reasons discussed below in respect of debt, the market value of equity is used for analysis purposes, instead of book value.

In order to determine the market value of equity, the average number of shares outstanding is multiplied by the average market price of AAL common stock, for each of the years 2004 to 2012. This information was obtained from the Bloomberg database.

Market value of debt

In order to determine the value of AAL's debt, the market value of debt was considered. Another measure of debt that could be used is book value. However, a number of arguments exist for the use of book values instead of market values (Damodaran, 2004). The first is that book values are less volatile than market values and are therefore more reliable. Although book values are more consistent than market values, it is for this reason that market values are considered to be a better indication of true value of debt as they change as and when new information is revealed. The second argument is that the use of book values is a more conservative approach to valuing debt. However, this argument assumes that market values of debts will always be lower than book values, which may not be correct. Furthermore, even in the case where market values are lower than book values, the cost of capital calculated using these book values will be lower than if market values are used, which does not suggest a more conservative approach. Another argument may be that debt is lent based on book values, and not market values. However, it cannot be said that debt is lent against assets valued at book value rather than market value (Damodaran, 2004). In their empirical research, Sweeny et al (1997) find that the use of book values in measuring debt distorts debt-to-equity ratio and cost of capital calculations. The distortion is especially found in time-series capital structure studies (Sweeny, Warga & Winters, 1997).

Although a portion of AAL debts, in the form of corporate bonds, are listed and traded, not all of AAL's debt is liquidly traded. In addition, as AAL is the parent company of the Group, a number of different entities within the group obtain debt of varies different kinds. The market value of AAL's debt is therefore not readily available. It is therefore necessary to estimate the market value of AAL's debt. To do so, we used an approach of Damodaran (2004) and calculated the market value of debt by treating the book value of debt as a coupon bond with the coupon equal to the actual interest expense recorded and the maturity equal to the weighted average maturity of the debt. Cost of debt is set as the current cost of debt of AAL as calculated by the sum of the risk-free rate and relevant default spread. Using this approach, the market value of debt of AAL for each of the years 2004 to 2012 can then be calculated as the current value of the bond:

$MV\ of\ Debt_t = IE_t \times [(1-1/(1+i_t)^m)/i_t]+DebtBV/(1+i_t)^m$

where IE_i equals the interest expense reported by AAL in year t, i equals the cost of debt in year t, m equals the weighted average maturity of debt outstanding in year t, and DebtBV is set as the reported book value of debt in year t.

The COD used in the equation above is the COD previously described as the risk-free rate plus the appropriate default spread based on AAL's reported Moody's credit rating. The weighted average maturity of debt outstanding is calculated form AAL's corporate bonds outstanding during the period under review, 2004 to 2012. The results are shown below.

Table 7: Market value of AAL debt

Market value of AAL debt									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Weighted average maturity (years)	4.29	3.08	2.29	1.51	3.42	5.27	5.41	4.83	4.95
Market value of debt (USD millions)	12826	9804	6899	8775	13648	12330	11950	11075	16202
Book value of debt (USD millions)	11200	8439	6248	8299	13995	14315	13439	12873	17635

Optimal Capital Structure determination

An optimal capital structure for AAL for each of the years 2004 to 2012 is estimated by considering the WACC of AAL over a range of debt levels. By analysis the outcomes of the estimated COE and COD for AAL when debt is increased from a debt-to-capital ratio of 0% to a ratio of 90%, the WACC is calculated for each level of debt. An optimal capital structure can then, by definition, be found where the WACC is minimised. The CAPM is again used to estimate COE for AAL in the model of ever increasing debt levels.

The COE is estimated for each level of debt (and equity) as defined by each decile of the debt-to-capital ratios. Calculations are performed for each of the scenarios where the debt-to-capital ratio is increased by ten percentage points from 0% to 90%. Hence, ten COE calculations are performed for each of the nine years under review. The scenario of 100% debt-to-capital is not investigated, as this does not depict a possible or realistic financing option.

The first component of the CAPM calculation of COE is beta. As discussed above, the actual historical beta values for AAL were calculated using a regression analysis of the five-year monthly returns of AAL and the SPX. Due to the fact that these regression beta values are calculated using historical data, they reflect the actual leverage positions of AAL over each of the periods calculated, respectively i.e. five-year mean leverage. It is therefore necessary to remove this effect of historical leverage from the regression beta values to obtain pure beta values. This is termed 'unlevering' the betas.

$B_{UL}=B_L/(1+(1-t)$ x D/E

where B_{UL} represents the unlevered beta; B_L is the historic levered beta; t equals the marginal tax rate; and D/E equals the mean debt-to-equity ratio of the five-year period.

In order to unlever the betas, the mean five-year debt-to-equity ratios over the corresponding beta periods were used. The resultant unlevered betas, for each year 2004-2012, therefore represent the historical regression betas adjusted to remove the effect of AAL's historical leverage.

The unlevered betas can then be used in our analysis of the different potential debt levels. These unlevered betas are then readjusted based on our ten tested debt scenarios. The unlevered betas are 're-levered' using the relevant levels of debt and equity in the optimal cost of equity calculation. The re-levered betas are then used in our CAPM calculations of COE.

$B_{RL}=B_{UL}$ x $[1+(1-t_I)$ x $D_I/E_I]$

where B_{RL} represents the re-levered beta, t_I is equal to the implied marginal tax rate and D_I/E_I is the implied debt to equity ratio.

By implication, the COE cannot be calculated without the COD being calculated simultaneously. This is true because some of the variables used in the method of the COE calculation are required to calculate COD, not because they are defined variables in terms of the CAPM, but because of our adopted application method used. The common variable is the marginal tax rate and its effect in calculating the re-levered betas. Therefore although beta is traditional only a variable in the CAPM calculation of COE, in our application, marginal tax rates may be impacted by the respective debt levels and therefore the re-levered betas may also be affected by debt. As a result, the COE is impacted by applicable the debt levels and the associated debt costs. This dependent relationship will be discussed in detail below in the section explaining the estimation of COD.

Once the re-levered betas have been determined, the same risk-free rates and equity risk premium are used to calculate the new cost of equity values.

Estimation of the COD

Pre-tax cost of debt

As for the calculation of the COE above, a COD value is calculated for each level of debt, for each year, 2004 to 2012. In estimating the optimal cost of capital, a similar process to that used to determine the actual cost of debt of AAL, is used. That is, the COD is calculated as the sum of the relevant risk-free rate and a suitable default spread, as determined by the company's credit rating. Default spreads were again taken from the Moody's MIR database, calculated as per annum arithmetic means from daily data, for each of the applicable credit ratings for the years 2004 to 2012.

As the level of debt changes, so too does its associated interest expense. The interest expense is determined both by the quantum of debt outstanding (as set by the debt scenario being tested) and by the applicable interest rate. However, as a company takes on increased debt, its risk profile, as represented by its credit rating, may increase, resulting in interest rates also increasing. Therefore, interest rates are not fixed but increase with increasing debt levels as credit ratings deteriorate.

To begin with, the current COD is applied to calculate interest expenses. As discussed above, the current COD is calculated as the sum of an appropriate default spread, corresponding to the actual reported credit rating of AAL, and the risk-free rate. As debt is increased, interest expenses calculated at the current COD interest rate also increase, lowering interest-coverage ratios. Lower interest-coverage ratios may result is lower expected credit ratings and therefore new higher interest rates (higher COD). These new higher interest rates in-turn increase interest expenses, which must be recalculated based on the new interest rates. An iterative approach must therefore be followed.

In performing this analysis, we implicitly assume that AAL can raise every level of debt and that all existing debt can be refinanced at the COD. Using this existing COD, the implied interest expense for each level of new debt is calculated. Once this has been determined, the implied interest-coverage ratios, for each year and for each level of debt, can be calculated. The implied interest-coverage ratio is used to evaluate whether any change in credit rating may be expected to occur due to the increased level of debt and its associated cost. In order to determine the new synthetic credit ratings (hereafter referred to as “synthetic ratings”), the findings of Damodaran regarding interest-coverage ratios and their corresponding typical credit ratings are used (Damodaran, 2004). Damodaran evaluated the interest-coverage ratios and corresponding credit ratings of large USA companies and compiled a matrix of typical interest-coverage ratios and corresponding credit ratings. These ratings are then used to determine default spreads over the reference rate, the risk-free rate (which remains constant). Using Damodaran’s matrix, the implied interest-coverage ratios are used to identify the new corresponding synthetic ratings.

Using interest-coverage ratios to determine credit ratings explicitly assumes that credit ratings are solely determined by interest coverage ratios. This is clearly a simple approach and not the case in practice. However, as explained by Damodaran, the interest-coverage ratio is used by ratings agencies in their ratings calculation and the ratio is significantly correlated to bond rating and other variables used in this approach (e.g. debt-coverage) (Damodaran, 2004). In addition as expected, the interest-coverage ratio changes as D/E ratios change. This is important in relation for our chosen method of analysis. The interest-coverage ratios and credit rating matrix compiled by Damodaran is shown in the table below.

Table 8: Synthetic ratings based on interest cover ratio

Synthetic ratings		
Interest-coverage (low)	Interest-coverage (high)	Moody’s Rating
-100000.00	0.1999	D2
0.20	0.6499	C2
0.65	0.7999	Ca2
0.80	1.2499	Caa
1.25	1.4999	B3
1.50	1.7499	B2
1.75	1.9999	B1
2.00	2.2499	Ba2
2.25	2.4999	Ba1
2.50	2.9999	Baa2
3.00	4.2499	A3
4.25	5.4999	A2
5.50	6.4999	A1
6.50	8.4999	Aa2
8.50	100000.00	Aaa

Once the synthetic rating and corresponding default spread have been obtained, the new implied interest rate is used to calculate a new implied interest expense and interest-coverage ratio. The same approach is followed again in an iterative process using the (higher) implied default spread and the same risk-free rate. The (higher) implied interest expense is recalculated in order to obtain a new (lower) implied interest-coverage ratio. It should be stated again that throughout this iterative process, EBIT (earnings before interest and tax) remains unchanged. This reflects the fact that we assume that any new debt is not used to alter or expand operations, but rather merely for capitalisation purposes. That is, any new debt is used merely to reduce equity.

In our analysis, EBIT is chosen as the income statement item representing operating profits. Strictly speaking, it is common and perhaps more correct to consider EBITDA (earnings before interest, tax, depreciation and amortization) as a true measure of operating profits. This is because EBITDA is not reduced by the non-cash items of depreciation and amortisation. EBITDA therefore represents the actual cash generated from operations. However, while this is true, it is not realistic to expect an asset intensive company, such as AAL, not to depreciate or amortize its assets for any extended length of time. Using EBITDA in our methodology would mean that our analysis would suffer from this problem. We therefore consider it more accurate to use EBIT as a measure of operating profit. In addition, using EBIT allows us to evaluate the effects of financing decisions on the tax shield.

This circular iterative process is continued until it is found that the implied credit rating, and therefore the associated default spread and, remains stable. At that point, the COD is found.

However, as mentioned earlier, the impact of increased interest expenses must simultaneously be considered in respect of the marginal tax rate. As discussed above, the UK marginal tax rate is used for the purposes of our analysis. However, in determining the optimal COD, it is necessary to consider, given the implied interest expense arising, whether the tax shield can actually be fully utilised, at each respective level of debt being analysed. As the debt-to-capital ratio increases from 0% to 90%, the interest expense burden, as expected, increases significantly. However, at the same time, EBIT remains constant. The tax shield can therefore only be fully utilised where the implied interest expense is less than or equal to reported EBIT. Where the implied interest expense is greater than EBIT, so much of the interest expense that exceeds EBIT will not benefit from the tax shield as the deduction for tax purposes is limited to the value of EBIT (we refer here to the benefit that can be realised in the current year).

High levels of debt are therefore not only more expensive as a result of poorer ratings, but are increasingly expensive in after-tax terms due to the reduced benefit of a tax deduction of interest or the tax shield in cases where the interest expense exceeds EBIT (i.e. not all interest can be deducted for tax purposes).

Increasing interest expense values to levels above EBIT therefore effectively result in reducing the marginal tax rate. The use of this implied marginal tax rate is appropriate as is accounts for the true scenario that any additional debt above that already considered (marginal debt) will not benefit at all from the tax shield. The cost of marginal debt is therefore automatically higher. The implied marginal tax rate is calculated as follows in cases where the implied interest expense exceeds EBIT:

$t_I = EBIT/IE \times t$

where, t_I represents the implied marginal tax rate, EBIT equals the maximum tax benefit, IE equals the interest expense and t is set at the current marginal tax rate.

Furthermore, as the marginal tax rate is included in the formula for the calculation of re-levered betas, so debt levels have a concomitant effect on re-levered betas and therefore the COE. Therefore, the values of the components of the calculation of the COD must be ascertained in order for the COE to be estimated.

In the calculation of the COD at each level of debt in the analysis, no condition limiting the level of debt which may be adopted, based on the credit rating and associated default spread, is applied. However, although not explicitly stated by AAL in its Annual Reports, it is reasonable to expect that the company would target (if not be compelled to maintain) an investment grade credit rating at all times. Therefore, although the above analysis may indicate that AAL may have optimal capacity to adopt an increasing quantum of debt, where such quantum of debt pushes AAL to obtain a non-investment grade rating, such debt must be considered excessive and unsatisfactory. An investment grade rating is any rating up to and including a Moody’s Baa3 rating. Any rating below Baa3 (i.e. starting at rating Ba1) is classified as non-investment grade and in not accepted for the purposes of our analysis. In the case of such a scenario, we select the optimal capital ratio to be that which provides AAL with the lowest WACC, while at the same time maintaining an investment grade credit rating.

4. Results

Actual historic results for AAL

As discussed above, we followed a CAPM approach for calculating the COE and resultant WACC for AAL for each of the years in the period 2004 to 2012. Using the methods described, the following results below were calculated for AAL. Based on actual historical results reported by

AAL, we found AAL to have a WACC that ranged from 7.66% in 2004 to 9.72% in 2012. The highest WACC obtained by AAL was in 2010 at 13.00%

Table 9: AAL's historical WACC

AAL Actual historical results									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Cost of equity (%)	9.20	9.71	9.80	13.83	13.87	14.54	14.52	13.29	12.15
After tax cost of debt (%)	3.41	3.61	4.01	4.07	4.84	4.95	4.08	3.91	3.23
Market value of equity (USD million)	35259	50811	72926	80739	29664	58790	69838	49550	43235
Market value of debt (USD million)	12826	9804	6899	8775	13648	12330	11950	11075	16202
Debt/Equity (%)	36.38	19.30	9.46	10.87	46.01	20.97	17.11	22.35	37.47
WACC (%)	7.66	8.72	9.30	12.88	11.03	12.87	13.00	11.58	9.72

As a comparison, we estimated an optimal capital structure position for AAL for 2004 to 2012.

Optimal cost of capital

Cost of equity

In calculating the optimal COE, the historical regression betas for AAL were unlevered to remove the effects of historical leverage and re-levered to account for the leverage of the specific debt and equity levels we were testing. The results of the re-levered betas are shown below.

Table 10: Re-levered betas

Debt-to-capital	Debt-to-equity	Re-levered betas								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
0%	0%	0.77	0.83	0.76	1.38	1.45	1.62	1.63	1.48	1.41
10%	11%	0.83	0.90	0.82	1.49	1.56	1.75	1.76	1.61	1.56
20%	25%	0.90	0.98	0.89	1.62	1.70	1.91	1.92	1.76	1.76
30%	43%	1.00	1.08	0.99	1.79	1.88	2.12	2.13	1.96	2.01
40%	67%	1.13	1.22	1.11	2.02	2.12	2.40	2.41	2.22	2.35
50%	100%	1.31	1.42	1.29	2.34	2.46	2.80	2.80	2.58	2.82
60%	150%	1.58	1.71	1.56	2.83	2.96	3.49	3.39	3.13	3.52
70%	233%	2.02	2.20	2.00	3.63	3.81	4.66	4.37	4.05	4.69
80%	400%	3.01	3.24	2.89	5.24	5.49	6.99	6.33	5.88	7.04
90%	900%	6.03	6.47	5.69	10.06	10.55	13.98	12.19	11.37	14.08

The marginal tax rate impacts on the COD as interest on debt is tax deductible. However, as explained above, the marginal tax rate also affects the COE due to the impact of the implied marginal tax rate on our re-levered beta. As a result, we also show the implied marginal tax rates below. The table below illustrates the changes in marginal tax rates as a result of increasing interest expenses. As expected, the tax shield is fully realised for low levels of debt. However, at high levels of debt, the implied marginal tax rate is reduced where the corresponding interest expense exceeds EBIT.

Table 11: Implied marginal taxation rates

Debt-to-capital	Debt-to-equity	Implied marginal taxation rates (%)								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
10%	11%	30.00	30.00	30.00	30.00	30.00	28.00	28.00	26.00	0.00
20%	25%	30.00	30.00	30.00	30.00	30.00	28.00	28.00	26.00	0.00
30%	43%	30.00	30.00	30.00	30.00	30.00	28.00	28.00	26.00	0.00
40%	67%	30.00	30.00	30.00	30.00	30.00	28.00	28.00	26.00	0.00
50%	100%	30.00	30.00	30.00	30.00	30.00	27.50	28.00	26.00	0.00
60%	150%	30.00	30.00	30.00	30.00	30.00	22.91	28.00	26.00	0.00
70%	233%	30.00	30.00	30.00	30.00	30.00	19.64	28.00	26.00	0.00
80%	400%	26.96	27.98	30.00	30.00	30.00	17.19	28.00	26.00	0.00
90%	900%	23.97	24.87	27.88	30.00	30.00	15.28	28.00	26.00	0.00

The effect on marginal tax rates can be clearly seen from the results in the table above. In 2012 for example, AAL recorded a negative EBIT value. As a result, in terms of theory and our methodology applied, AAL should not have reported any debt in 2012 as if could not afford it. Of course, this is unrealistic as debt is not issued and repaid all in a single year. Instead, it is more correct to say that AAL should not have issued any new debt in 2012. Due to the fact that AAL could not afford the debt in 2012, at any level, it receives no tax shield benefit on the cost of the debt. The implied marginal tax rates are therefore shown as zero in 2012.

The resultants COE estimates for each year under review and for each level of debt-to-equity are shown in the table below,

Table 12: Estimated cost of equity

Debt-to-capital	Debt-to-equity	Cost of Equity (%)								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
0%	0%	8.91	9.32	9.38	12.95	12.38	13.04	13.05	11.74	10.29
10%	11%	9.27	9.71	9.73	13.60	13.06	13.82	13.83	12.47	11.23
20%	25%	9.72	10.20	10.18	14.40	13.91	14.79	14.81	13.39	12.41
30%	43%	10.30	10.82	10.75	15.44	15.00	16.05	16.08	14.58	13.93
40%	67%	11.07	11.66	11.52	16.83	16.45	17.73	17.76	16.15	15.95
50%	100%	12.15	12.84	12.59	18.77	18.48	20.12	20.12	18.36	18.78
60%	150%	13.77	14.59	14.19	21.68	21.54	24.33	23.66	21.67	23.02
70%	233%	16.48	17.53	16.86	26.53	26.62	31.36	29.56	27.20	30.10
80%	400%	22.45	23.80	22.21	36.23	36.79	45.40	41.36	38.24	44.24
90%	900%	40.63	43.31	39.13	65.33	67.31	87.54	76.74	71.37	86.68

Cost of debt

Corresponding to increased levels of debt, interest expenses increase and in turn result in lower interest-coverage ratios being observed as a result of EBIT being held constant. Deteriorating interest-coverage ratios may in turn result in poorer credit ratings being obtained as leverage is increased. The implied credit ratings observed from our analysis are shown in the table below.

Table 13: Implied credit ratings for AAL

Debt-to-capital	Debt-to-equity	Implied Moody's credit ratings for AAL								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
0%	0%	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa
10%	11%	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	D2
20%	25%	Aa2	Aaa	Aaa	Aaa	Aaa	A1	Aaa	Aaa	D2
30%	43%	A2	A1	A1	A1	Aaa	A3	Aaa	Aaa	D2
40%	67%	A3	A2	A3	A3	Aaa	B3	Aaa	Aaa	D2
50%	100%	A3	A3	A3	A3	Aa2	Caa	Aa2	Aaa	D2
60%	150%	B2	Baa2	Baa2	Baa2	A2	Caa	A1	A1	D2
70%	233%	Caa	B2	B2	B1	A2	Ca2	A2	A2	D2
80%	400%	Caa	Caa	Caa	B3	A3	C2	A3	A3	D2
90%	900%	Ca2	Caa	Caa	Caa	A3	C2	A3	A3	D2

The results of our calculations using the circular iterative methodology find the after-tax COD estimates shown in the table below.

Table 14: Estimated after-tax cost of debt

Debt-to-capital	Debt-to-equity	After-tax cost of debt (%)								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
10%	11%	3.09	3.25	3.63	3.62	3.28	2.99	2.87	2.66	10.78
20%	25%	3.15	3.25	3.63	3.62	3.28	3.99	2.87	2.66	10.78
30%	43%	3.31	3.46	3.92	4.00	3.28	4.54	2.87	2.66	10.78
40%	67%	3.41	3.53	4.10	4.17	3.28	8.61	2.87	2.66	10.78
50%	100%	3.41	3.61	4.10	4.17	4.03	9.04	3.34	2.66	10.78
60%	150%	5.77	3.83	4.34	4.39	4.59	9.61	3.55	3.35	10.78
70%	233%	7.31	5.72	5.96	5.35	4.59	10.01	3.66	3.43	10.78
80%	400%	7.63	8.42	7.90	6.16	4.84	10.32	3.86	3.65	10.78
90%	900%	7.94	8.78	8.14	7.16	4.84	10.56	3.86	3.65	10.78

Once the COE and COD value have been estimated, the WACC is calculated for each scenario. The full table of results is shown below. However, of interest is the minimum WACC estimated for each year and the corresponding level of debt which gives rise to the lowest cost of capital.

Table 15: Estimated WACC

Debt-to-capital	Debt-to-equity	WACC (%)								
		2004	2005	2006	2007	2008	2009	2010	2011	2012
0%	0%	8.91	9.32	9.38	12.95	12.38	13.04	13.05	11.74	10.29
10%	11%	8.65	9.06	9.12	12.60	12.08	12.73	12.74	11.49	11.19
20%	25%	8.40	8.81	8.87	12.25	11.78	12.63	12.43	11.25	12.09
30%	43%	8.20	8.62	8.70	12.01	11.48	12.60	12.12	11.00	12.98
40%	67%	8.00	8.41	8.55	11.76	11.18	14.08	11.81	10.75	13.88
50%	100%	7.78	8.22	8.34	11.47	11.26	14.58	11.73	10.51	14.78
60%	150%	8.97	8.13	8.28	11.30	11.37	15.50	11.59	10.68	15.68
70%	233%	10.06	9.27	9.23	11.71	11.20	16.42	11.43	10.56	16.58
80%	400%	10.59	11.50	10.76	12.18	11.23	17.34	11.36	10.57	17.47
90%	900%	11.21	12.24	11.24	12.98	11.09	18.26	11.15	10.42	18.37

The minimum WACC and the corresponding optimal levels of debt are shown in the table below for each year analysed. As discussed previously, while it is important to determine the lowest WACC in any particular year, it is also important that the optimal WACC be found at a level which results in AAL recording an investment grade credit rating. As seen from the results depicted in the table below, none of the implied Moody's credit ratings found for AAL in the analysis are below the Baa3 rating. All minimum WACC estimates are therefore found with corresponding investment grade implied ratings. It is therefore not necessary to adjust the results in order to account for non-investment grade ratings. In the case of the 2012 year, the negative EBIT recorded results in an implied credit rating of the lowest rating, namely D2. A D2 rating results in a debt being very costly. In addition, in 2012 AAL could derive no benefit from the tax shield. As a result, the optimal level of debt for AAL in 2012 is no debt at all, i.e. the lowest WACC is found to be equal to the COE. This is consistent with our comment that, in 2012, AAL could not afford to hold any debt at all as it did not derive sufficient operating profit (at the EBIT level) to service any debt.

Table 16: Estimated optimal capital structure

Optimal capital structure (%)										
		2004	2005	2006	2007	2008	2009	2010	2011	2012
Optimal	WACC	7.78	8.13	8.28	11.30	11.09	12.60	11.15	10.42	10.29
	Rating	A3	Baa2	Baa2	Baa2	A3	A3	A3	A3	Aaa
	D/(D+E)	50	80.00	60.00	60.00	90.00	30.00	90.00	90.00	0.00
	D/E	100	400.00	150.00	150.0	900.00	42.86	900.00	900.00	0.00

The optimal capital structure for AAL is therefore found at the combinations of equity and debt where WACC is minimised in each of the years 2004 to 2012. The lowest implied WACC for the period reviewed is found in 2004 where the cost of capital is estimated to be lowest with equal levels of equity and debt. The highest optimal WACC is found in 2009 at 12.60% at an optimal implied debt-to equity ratio of 42.86%.

Conclusion

Compared to the historical position of AAL, our findings suggest that AAL had a far greater capacity for debt during the period 2004 to 2012. Never did AAL's historical debt-to-equity ratio exceed 50% during the period, while our analysis would suggest that apart from 2009, the optimal debt-to-capital ratio far exceeded this. In addition, except for 2012, moving to the estimated optimal debt-to-equity weightings would result in higher firm value due to a lower WACC.

Table 17: Estimated optimal capital structure versus actual reported

Optimal capital structure (%)										
		2004	2005	2006	2007	2008	2009	2010	2011	2012
Optimal	WACC	7.78	8.13	8.28	11.30	11.09	12.60	11.15	10.42	10.29
	D/(D+E)	50	80.00	60.00	60.00	90.00	30.00	90.00	90.00	0.00
	D/E	100	400.00	150.00	150.0	900.00	42.86	900.00	900.00	0.00
Actual	WACC	7.66	8.72	9.30	12.88	11.03	12.87	13.00	11.58	9.72
	D/(D+E)	26.67	16.17	8.64	9.80	31.51	17.34	14.61	18.27	27.26
	D/E	36.38	19.30	9.46	10.87	46.01	20.97	17.11	22.35	37.47

Compared to the actual capital structure calculations obtained for AAL, it does not appear that any particular capital structure was targeted by management. Furthermore, the share repurchase program did not result in a lasting target being achieved. We make this observation based on the fact that no similarity in actual capital structure results is observed for the years 2004 to 2012 for AAL.

As discussed above, the share repurchase program undertaken by AAL did not add value to shareholders. Furthermore, the repurchase of shares does not appear to have been done with the intention to alter AAL's capital structure to be in line with any particular target. In addition, in the years both before and after the share repurchase, the company was significantly under leveraged when considering the optimal scenarios estimated.

The question therefore arises whether there may be other explanations which may shed light on why AAL adopted the capital structure which it did, and in particular, why is was so significantly under leveraged during the period under review. We briefly consider these aspects below.

5. Other Capital Structure considerations

Even though a firm may have capacity for debt, it may not fully utilise this available debt. This may because management may choose to reserve funding capacity for the prospect of undertaking future investment opportunities that may arise. Highly leverage firms are more likely to not undertake profitable investments (Myers, 1977). High growth firms should therefore rather use greater proportions of equity finance. In the case of AAL, new projects require significant capital investment. Furthermore, such investments typically have long lead-times before generating operating income. It is argued that leverage is positively correlated with fixed assets, non-debt tax shield, investment opportunities and firm size while negatively correlated with volatility, risk of bankruptcy, profitability and product uniqueness (Harris & Raviv, 1991). Regarding assets, if a large proportion of a firm's assets are tangible and fixed, then these assets could serve as security to a lender and therefore reduce the risk of default and agency costs and, in the case of default, such assets would be expected to retain their value. Therefore, higher reported tangible assets would be expected to result in higher leverage (Rajan & Zingales, 1995). Rajan & Zingales (1995) discuss the correlation between firm size and leverage and state that "larger firms tend to be more diversified and fail less often, so size may be an inverse proxy for the probability of bankruptcy". If this is the case, size would be expected to be positively correlated to leverage. The theory of the effect of profitability on leverage is somewhat less clear. Consistent with the pecking order theory, Myers & Majluf (1984) suggest a negative relationship, as profitable firms will first use internal funds for financing. However, Jensen (1986) suggests a positive relationship if firms are forced to commit to returning cash by increasing leverage.

We follow the approach of Rajan & Zingales (1995) in investigating these above factors. They find that the measures fixed-asset-to-total-assets (what they term 'tangibility) and firm size are both positively correlated to leverage. Furthermore, they find investment opportunities and profitability to be negatively correlated with leverage. Firm size is measured as the logarithm of net-sales. Investment opportunities are measured by the market-to-book value as a proxy. Profitability is measure as EBITDA over the book value of assets.

We therefore used the approach of Rajan & Zingales (1995) and their measures used, to investigate whether the results of AAL provide similar findings. These four metrics discussed above are presented and discussed for AAL below.

Table 18: AAL historical results

AAL									
	2004	2005	2006	2007	2008	2009	2010	2011	2012
Tangibility	0.86	0.85	0.77	0.74	0.78	0.86	0.82	0.77	0.79
Investment opportunities	1.14	1.45	1.99	2.26	1.16	1.55	1.48	1.09	0.99
Firm size	4.42	4.47	4.40	4.41	4.42	4.32	4.45	4.49	4.46
Profitability	10.70	14.78	20.84	22.16	20.08	10.79	18.25	15.75	0.98
D/E (%)	36.38	19.30	9.46	10.87	46.01	20.97	17.11	22.35	37.47

AAL’s reported leverage first decreased between 2004 and 2006. During this time, tangibility decreased, investment opportunities increased, firm size increased before decreasing and profitability increased. These results would seem to broadly match the correlation findings of Rajan & Zingales (1995) relating to leverage.

During 2007 and 2008, AAL’s calculated leverage then increased, significantly in 2008. During these two years, tangibility and firm size increase while investment opportunities and profitability both decreased. These movements match the correlation relationship found by Rajan & Zingales (1995).

AAL’s leverage then decreased again in 2009 and 2010. During this period, only the movements in the tangibility and profitability measurements confirm the correlation relationships found.

Lastly, AAL’s calculated leverage then increased again in 2011 and 2012. Tangibility decreased in 2011 before increasing in 2012. Both measured investment opportunities and profitability were lower in the 2011 and 2012. Firm size increased in 2011 before decreasing in 2012. The changes in the measures of investment opportunities and profitability therefore both match the correlation results of Rajan & Zingales (1995) whereas the findings for tangibility and firm size are mixed.

6. Conclusion

During 2006, AAL adopted and implemented its first share repurchase program, which continued up until its suspension in 2008. While management stated that share repurchases would only be done in the interest of shareholders, the repurchase program was disastrous for shareholder value. Management also stated that share repurchases provide the firm with flexibility regarding its capital structure.

We investigated the capital structure of AAL for the years 2004 to 2012 from an optimal capital structure perspective. Using a CAPM approach, we find no evidence that AAL targeted or implemented a capital structure, which could be considered optimal. In fact, no specific capital structure seems to have been targeted at all as no consistency in results is found, even after the share repurchase program.

The optimal capital structure calculated suggests a greater portion of debt should have been adopted by AAL. Given that no information is provided as to a specific capital structure targeted by AAL, it is not clear whether the capital structure was actively managed, perhaps by share repurchases, during the period of review. However, based on the CAPM approach and optimal capital structure define as that which minimises WACC, the actual capital structure adopted by AAL was sub-optimal for all but three of the nine years reviewed.

Due to the complex nature of capital structure design decisions, and in consideration of our optimal structure findings, we considered other empirical studies to try to better understand the reported capital structure of AAL witnessed. Using measures for fixed assets, firm size, investment opportunities and profitability, we investigated whether these additional characteristics of AAL, and their relationships to each other, might explain the observed capital structure of AAL. We find that the results of AAL do broadly agree with the empirical study of Rajan & Zingales (1995) who find leverage to be positively correlated to fixed-asset-to-total-assets values and to firm size while being negatively correlated to investment opportunities and profitability. However, it is difficult to tell to what extent these measures influenced the design of AAL's adopted capital structure over the period 2004 to 2012.

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Appendix 1: Workings per year 2004 to 2012

2004

D/(D+E)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	4809	9617	14426	19234	24043	28851	33660	38468	43277
Re-levered Beta	0.77	0.83	0.90	1.00	1.13	1.31	1.58	2.02	3.01	6.03
EBIT	3612	3612	3612	3612	3612	3612	3612	3612	3612	3612
Interest expense	0	213	433	681	936	1170	2377	3517	4019	4521
Implied tax rate (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	26.96	23.97
Interest cover	-	16.99	8.35	5.30	3.86	3.09	1.52	1.03	0.90	0.80
Implied rating	Aaa	Aaa	Aa2	A2	A3	A3	B2	Caa	Caa	Ca2
Pre-tax cost of debt (%)	4.42	4.42	4.50	4.72	4.86	4.86	8.24	10.45	10.45	10.45
Cost of Equity (%)	8.91	9.27	9.72	10.30	11.07	12.15	13.77	16.48	22.45	40.63
After tax cost of debt (%)	3.09	3.09	3.15	3.31	3.41	3.41	5.77	7.31	7.63	7.94
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	8.91	8.34	7.77	7.21	6.64	6.08	5.51	4.94	4.49	4.06
WACD (%)	0.00	0.31	0.63	0.99	1.36	1.70	3.46	5.12	6.10	7.15
WACC (%)	*8.91*	*8.65*	*8.40*	*8.20*	*8.00*	*7.78*	*8.97*	*10.06*	*10.59*	*11.21*

2005

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	6061	12123	18184	24246	30307	36369	42430	48492	54553
Re-levered Beta	0.83	0.90	0.98	1.08	1.22	1.42	1.71	2.20	3.24	6.47
EBIT	5288	5288	5288	5288	5288	5288	5288	5288	5288	5288
Interest expense	0	281	563	900	1221	1563	1988	3470	5669	6378
Implied tax rate (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	27.98	24.87
Interest cover	-	18.79	9.39	5.88	4.33	3.38	2.66	1.52	0.93	0.83
Implied rating	Aaa	Aaa	Aaa	A1	A2	A3	Baa2	B2	Caa	Caa
Pre-tax cost of debt (%)	4.64	4.64	4.64	4.95	5.04	5.16	5.47	8.18	11.69	11.69
Cost of Equity (%)	9.32	9.71	10.20	10.82	11.66	12.84	14.59	17.53	23.80	43.31
After tax cost of debt (%)	3.25	3.25	3.25	3.46	3.53	3.61	3.83	5.72	8.42	8.78
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	9.32	8.74	8.16	7.58	7.00	6.42	5.84	5.26	4.76	4.33
WACD (%)	0.00	0.33	0.65	1.04	1.41	1.81	2.30	4.01	6.74	7.90
WACC (%)	*9.32*	*9.06*	*8.81*	*8.62*	*8.41*	*8.22*	*8.13*	*9.27*	*11.50*	*12.24*

2006

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	8764	17528	26291	35055	43819	52583	61346	70110	78874
Re-levered Beta	0.76	0.82	0.89	0.99	1.11	1.29	1.56	2.00	2.89	5.69
EBIT	8274	8274	8274	8274	8274	8274	8274	8274	8274	8274
Interest expense	0	454	909	1474	2054	2568	3258	5220	7914	8903
Implied tax rate (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	27.88
Interest cover	-	18.21	9.11	5.61	4.03	3.22	2.54	1.59	1.05	0.93
Implied rating	Aaa	Aaa	Aaa	A1	A3	A3	Baa2	B2	Caa	Caa
Pre-tax cost of debt (%)	5.18	5.18	5.18	5.61	5.86	5.86	6.20	8.51	11.29	11.29
Cost of Equity (%)	9.38	9.73	10.18	10.75	11.52	12.59	14.19	16.86	22.21	39.13
After tax cost of debt (%)	3.63	3.63	3.63	3.92	4.10	4.10	4.34	5.96	7.90	8.14
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	9.38	8.76	8.14	7.53	6.91	6.29	5.68	5.06	4.44	3.91
WACD (%)	0.00	0.36	0.73	1.18	1.64	2.05	2.60	4.17	6.32	7.33
WACC (%)	*9.38*	*9.12*	*8.87*	*8.70*	*8.55*	*8.34*	*8.28*	*9.23*	*10.76*	*11.24*

2007

D/(D+E)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	8951	17903	26854	35805	44757	53708	62659	71611	80562
Re-levered Beta	1.38	1.49	1.62	1.79	2.02	2.34	2.83	3.63	5.24	10.06
EBIT	8522	8522	8522	8522	8522	8522	8522	8522	8522	8522
Interest expense	0	463	925	1533	2131	2664	3367	4792	6305	8242
Implied tax rate (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Interest cover	-	18.42	9.21	5.56	4.00	3.20	2.53	1.78	1.35	1.03
Implied rating	Aaa	Aaa	Aaa	A1	A3	A3	Baa2	B1	B3	Caa
Pre-tax cost of debt (%)	5.17	5.17	5.17	5.71	5.95	5.95	6.27	7.65	8.80	10.23
Cost of Equity (%)	12.95	13.60	14.40	15.44	16.83	18.77	21.68	26.53	36.23	65.33
After tax cost of debt (%)	3.62	3.62	3.62	4.00	4.17	4.17	4.39	5.35	6.16	7.16
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	12.95	12.24	11.52	10.81	10.10	9.38	8.67	7.96	7.25	6.53
WACD (%)	0.00	0.36	0.72	1.20	1.67	2.08	2.63	3.75	4.93	6.45
WACC (%)	*12.95*	*12.60*	*12.25*	*12.01*	*11.76*	*11.47*	*11.30*	*11.71*	*12.18*	*12.98*

2008

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	4331	8662	12994	17325	21656	25987	30318	34650	38981
Re-levered Beta	1.45	1.56	1.70	1.88	2.12	2.46	2.96	3.81	5.49	10.55
EBIT	8477	8477	8477	8477	8477	8477	8477	8477	8477	8477
Interest expense	0	203	405	608	811	1247	1706	1990	2395	2695
Implied tax rate (%)	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00	30.00
Interest cover	-	41.83	20.92	13.94	10.46	6.80	4.97	4.26	3.54	3.15
Implied rating	Aaa	Aaa	Aaa	Aaa	Aaa	Aa2	A2	A2	A3	A3
Pre-tax cost of debt (%)	4.68	4.68	4.68	4.68	4.68	5.76	6.56	6.56	6.91	6.91
Cost of Equity (%)	12.38	13.06	13.91	15.00	16.45	18.48	21.54	26.62	36.79	67.31
After tax cost of debt (%)	3.28	3.28	3.28	3.28	3.28	4.03	4.59	4.59	4.84	4.84
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	12.38	11.75	11.13	10.50	9.87	9.24	8.61	7.99	7.36	6.73
WACD (%)	0.00	0.33	0.66	0.98	1.31	2.02	2.76	3.22	3.87	4.36
WACC (%)	*12.38*	*12.08*	*11.78*	*11.48*	*11.18*	*11.26*	*11.37*	*11.20*	*11.23*	*11.09*

2009

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	7112	14224	21336	28448	35560	42672	49783	56895	64007
Re-levered Beta	1.62	1.75	1.91	2.12	2.40	2.80	3.49	4.66	6.99	13.98
EBIT	4352	4352	4352	4352	4352	4352	4352	4352	4352	4352
Interest expense	0	295	788	1344	3401	4432	5318	6204	7091	7977
Implied tax rate (%)	28.00	28.00	28.00	28.00	28.00	27.50	22.91	19.64	17.19	15.28
Interest cover	-	14.73	5.52	3.24	1.28	0.98	0.82	0.70	0.61	0.55
Implied rating	Aaa	Aaa	A1	A3	B3	Caa	Caa	Ca2	C2	C2
Pre-tax cost of debt (%)	4.15	4.15	5.54	6.30	11.96	12.46	12.46	12.46	12.46	12.46
Cost of Equity (%)	13.04	13.82	14.79	16.05	17.73	20.12	24.33	31.36	45.40	87.54
After tax cost of debt (%)	2.99	2.99	3.99	4.54	8.61	9.04	9.61	10.01	10.32	10.56
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	13.04	12.44	11.84	11.24	10.64	10.06	9.73	9.41	9.08	8.75
WACD (%)	0.00	0.30	0.80	1.36	3.44	4.52	5.76	7.01	8.26	9.50
WACC (%)	*13.04*	*12.73*	*12.63*	*12.60*	*14.08*	*14.58*	*15.50*	*16.42*	*17.34*	*18.26*

2010

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	6150	12300	18450	24600	30750	36900	43050	49200	55350
Re-levered Beta	1.63	1.76	1.92	2.13	2.41	2.80	3.39	4.37	6.33	12.19
EBIT	10245	10245	10245	10245	10245	10245	10245	10245	10245	10245
Interest expense	0	245	491	736	982	1428	1818	2191	2638	2968
Implied tax rate (%)	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00	28.00
Interest cover	-	41.73	20.87	13.91	10.43	7.17	5.63	4.68	3.88	3.45
Implied rating	Aaa	Aaa	Aaa	Aaa	Aaa	Aa2	A1	A2	A3	A3
Pre-tax cost of debt (%)	3.99	3.99	3.99	3.99	3.99	4.64	4.93	5.09	5.36	5.36
Cost of Equity (%)	13.05	13.83	14.81	16.08	17.76	20.12	23.66	29.56	41.36	76.74
After tax cost of debt (%)	2.87	2.87	2.87	2.87	2.87	3.34	3.55	3.66	3.86	3.86
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	13.05	12.45	11.85	11.25	10.66	10.06	9.46	8.87	8.27	7.67
WACD (%)	0.00	0.29	0.57	0.86	1.15	1.67	2.13	2.57	3.09	3.47
WACC (%)	*13.05*	*12.74*	*12.43*	*12.12*	*11.81*	*11.73*	*11.59*	*11.43*	*11.36*	*11.15*

2011

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	6062	12125	18187	24250	30312	36375	42437	48500	54562
Re-levered Beta	1.48	1.61	1.76	1.96	2.22	2.58	3.13	4.05	5.88	11.37
EBIT	9439	9439	9439	9439	9439	9439	9439	9439	9439	9439
Interest expense	0	218	435	653	871	1088	1646	1967	2392	2691
Implied tax rate (%)	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00	26.00
Interest cover	-	43.36	21.68	14.45	10.84	8.67	5.74	4.80	3.95	3.51
Implied rating	Aaa	Aaa	Aaa	Aaa	Aaa	Aaa	A1	A2	A3	A3
Pre-tax cost of debt (%)	3.59	3.59	3.59	3.59	3.59	3.59	4.52	4.64	4.93	4.93
Cost of Equity (%)	11.74	12.47	13.39	14.58	16.15	18.36	21.67	27.20	38.24	71.37
After tax cost of debt (%)	2.66	2.66	2.66	2.66	2.66	2.66	3.35	3.43	3.65	3.65
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	11.74	11.22	10.71	10.20	9.69	9.18	8.67	8.16	7.65	7.14
WACD (%)	0.00	0.27	0.53	0.80	1.06	1.33	2.01	2.40	2.92	3.29
WACC (%)	*11.74*	*11.49*	*11.25*	*11.00*	*10.75*	*10.51*	*10.68*	*10.56*	*10.57*	*10.42*

2012

D/(D+E)	**0%**	**10%**	**20%**	**30%**	**40%**	**50%**	**60%**	**70%**	**80%**	**90%**
D/E	**0%**	**11%**	**25%**	**43%**	**67%**	**100%**	**150%**	**233%**	**400%**	**900%**
Debt value	0	5944	11887	17831	23775	29719	35662	41606	47550	53493
Re-levered Beta	1.41	1.56	1.76	2.01	2.35	2.82	3.52	4.69	7.04	14.08
EBIT	-1600	-1600	-1600	-1600	-1600	-1600	-1600	-1600	-1600	-1600
Interest expense	0	641	1282	1922	2563	3204	3845	4486	5126	5767
Implied tax rate (%)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Interest cover	-	-2.50	-1.25	-0.83	-0.62	-0.50	-0.42	-0.36	-0.31	-0.28
Implied rating	Aaa	D2	D2	D2	D2	D2	D2	D2	D2	D2
Pre-tax cost of debt (%)	2.57	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78
Cost of Equity (%)	10.29	11.23	12.41	13.93	15.95	18.78	23.02	30.10	44.24	86.68
After tax cost of debt (%)	2.57	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78	10.78
wEQUITY (%)	100%	90%	80%	70%	60%	50%	40%	30%	20%	10%
wDEBT (%)	0%	10%	20%	30%	40%	50%	60%	70%	80%	90%
WACE (%)	10.29	10.11	9.93	9.75	9.57	9.39	9.21	9.03	8.85	8.67
WACD (%)	0.00	1.08	2.16	3.23	4.31	5.39	6.47	7.55	8.63	9.70
WACC (%)	*10.29*	*11.19*	*12.09*	*12.98*	*13.88*	*14.78*	*15.68*	*16.58*	*17.47*	*18.37*

Appendix 2: COD per credit rating used in analysis

Interest cover		Credit rating	COD (%)*								
Low	**High**		**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**
-100000.00	0.1999	D2	10.45	11.69	11.29	10.23	12.51	12.46	9.95	9.83	10.78
0.20	0.6499	C2	10.45	11.69	11.29	10.23	12.51	12.46	9.95	9.83	10.78
0.65	0.7999	Ca2	10.45	11.69	11.29	10.23	12.51	12.46	9.95	9.83	10.78
0.80	1.2499	Caa	10.45	11.69	11.29	10.23	12.51	12.46	9.95	9.83	10.78
1.25	1.4999	B3	8.92	9.28	9.66	8.80	11.82	11.96	9.78	9.45	10.01
1.50	1.7499	B2	8.24	8.18	8.51	8.24	11.01	11.39	9.75	9.31	9.69
1.75	1.9999	B1	7.46	7.56	8.16	7.65	10.21	10.51	8.84	8.45	8.16
2.00	2.2499	Ba2	6.86	6.94	7.25	7.18	9.15	9.35	8.12	7.55	7.29
2.25	2.4999	Ba1	6.18	6.31	6.83	6.83	8.63	8.67	7.29	6.82	6.26
2.50	2.9999	Baa2	5.30	5.47	6.20	6.27	7.75	7.55	6.03	5.68	4.75
3.00	4.2499	A3	4.86	5.16	5.86	5.95	6.91	6.30	5.36	4.93	3.83
4.25	5.4999	A2	4.72	5.04	5.72	5.82	6.56	5.82	5.09	4.64	3.49
5.50	6.4999	A1	4.63	4.95	5.61	5.71	6.26	5.54	4.93	4.52	3.34
6.50	8.4999	Aa2	4.50	4.81	5.41	5.52	5.76	5.08	4.64	4.32	3.09
8.50	100000.00	Aaa	4.42	4.64	5.18	5.17	4.68	4.15	3.99	3.59	2.57

Source: *Credit spread information obtained from Moody's MIR database, used with the permission of Moody's